Answer on Question#41320, Physics, Optics

On a polarizing sheet a mixture of plane polarized and unpolarized light falls normally. On rotating the polarizing sheet about the direction of the incident beam, the transmitted maximum and minimum intensities vary by a factor 4. The ratio of the intensities of polarized and unpolarized light is?

Solution:

If a beam contains a mix of plane polarized light and unpolarized light the fraction of the polarized light can be determined by continuously measuring the transmittance through a polarizer as this is rotated through an angle of 90◦ about the beam axis. At maximum all the polarized and half the unpolarized light is transmitted, while at the minimum simply half the unpolarized light is transmitted.

Thus,

$$I_{max} = I_p + \frac{I_u}{2}$$

$$I_{min} = \frac{I_u}{2}$$

where I_p is the intensity of plane polarized light, and I_u is the intensity of unpolarized light.

We have that

$$\frac{I_{max}}{I_{min}} = 4$$

Thus,

$$\frac{I_p + \frac{I_u}{2}}{\frac{I_u}{2}} = 4$$

$$I_p + \frac{I_u}{2} = 4\frac{I_u}{2}$$

$$I_p = \frac{3I_u}{2}$$

So,

$$\frac{I_p}{I_u} = \frac{3}{2} = 1.5$$

Answer. $\frac{I_p}{I_u} = \frac{3}{2} = 1.5.$